

A PAL HEALTH BOOK



# THE BODY MACHINE

PARTS & FUNCTIONS



PAL HEALTH SERIES

# THE BODY MACHINE

## PARTS & FUNCTIONS

### BOOK ONE

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# CHAPTER ONE

## BONES & MUSCLE



### AFTER THE GAME



Sprained ankles. Sprained fingers. Just about everybody suffers a sprain sometime. What happens when you sprain something? Well, your bones are held together by cords. These cords are like strong rubber bands. They're called *ligaments*.

Sprains happen when ligaments are twisted or stretched by a sudden movement. All it takes is a quick twist or a blow, and—bingo—you've got a sprain. But you can treat it yourself if you know what to do.



# HOW TO TREAT A SPRAIN

1. PUT ICE ON THE SPRAIN OR SOAK IT IN COLD WATER TO MAKE THE SWELLING GO DOWN.



2. EACH DAY AFTER, SOAK IT IN HOT WATER WITH SOME EPSOM SALTS IN IT—ONCE IN THE MORNING AND AGAIN AT NIGHT—UNTIL IT'S BETTER.



3. KEEP THE SPRAIN WRAPPED TIGHTLY WITH A BANDAGE AND TRY NOT TO USE THE INJURED JOINT.



OK, YOU'RE NEXT, GLUEFINGERS. GLUEFINGERS DROPPED THREE PASSES TODAY. TELL THE DOC YOUR PROBLEM, GLUE.

TAKE A LOOK AT THIS FOOT, DOC. IT FEELS LIKE A TANK RAN OVER IT.



NOTHING BROKEN HERE. JUST A BAD BRUISE. KEEP AN ICE PACK ON IT FOR AN HOUR OR SO. TOMORROW SOAK IT IN HOT WATER. IT'LL BE SORE FOR AWHILE BUT YOU CAN WALK ON IT. OK, WHO'S NEXT?



OH YOU, KING? WHAT AILS THE STAR QUARTER-BACK? YOUR PASSES WERE WAY OFF TODAY.

I CAN HARDLY LIFT MY ARM, DOC. IT FEELS NUMB AND SORE.



HUMMM! JUST A SLIGHT CASE OF MUSCLE STRAIN FROM ALL THOSE PASSES YOU THREW. REST THE OLD WING FOR A COUPLE OF DAYS.







### Mind Muscles

Circle the word or words in each sentence that makes the sentence correct.

1. If you have a sprain, soaking it in (hot, cold) water helps make the swelling go down.
2. (Strains, sprains) should be wrapped with a bandage to keep the bones from moving at the injured joint.
3. (Rest and heat, ice and exercise) are best for muscle strain.
4. Broken blood vessels under the skin often become black and blue when a muscle has been (bruised, strained).
5. The best way for you to keep your muscles in good shape is by (resting them, daily exercise).

Bruises. Muscle strains. You've probably had them. But not everybody knows what to do about them. A hard blow will bruise a muscle. The blow causes tiny blood vessels under your skin to break. Most of the time, gentle rubbing, heat, and light exercise will take the soreness away.

Strains can be even more painful. If a muscle gets more exercise than it's used to, it becomes stiff. That's one good reason why daily exercise is important. Daily exercise keeps your muscles in good shape so they're ready to use when you need them.

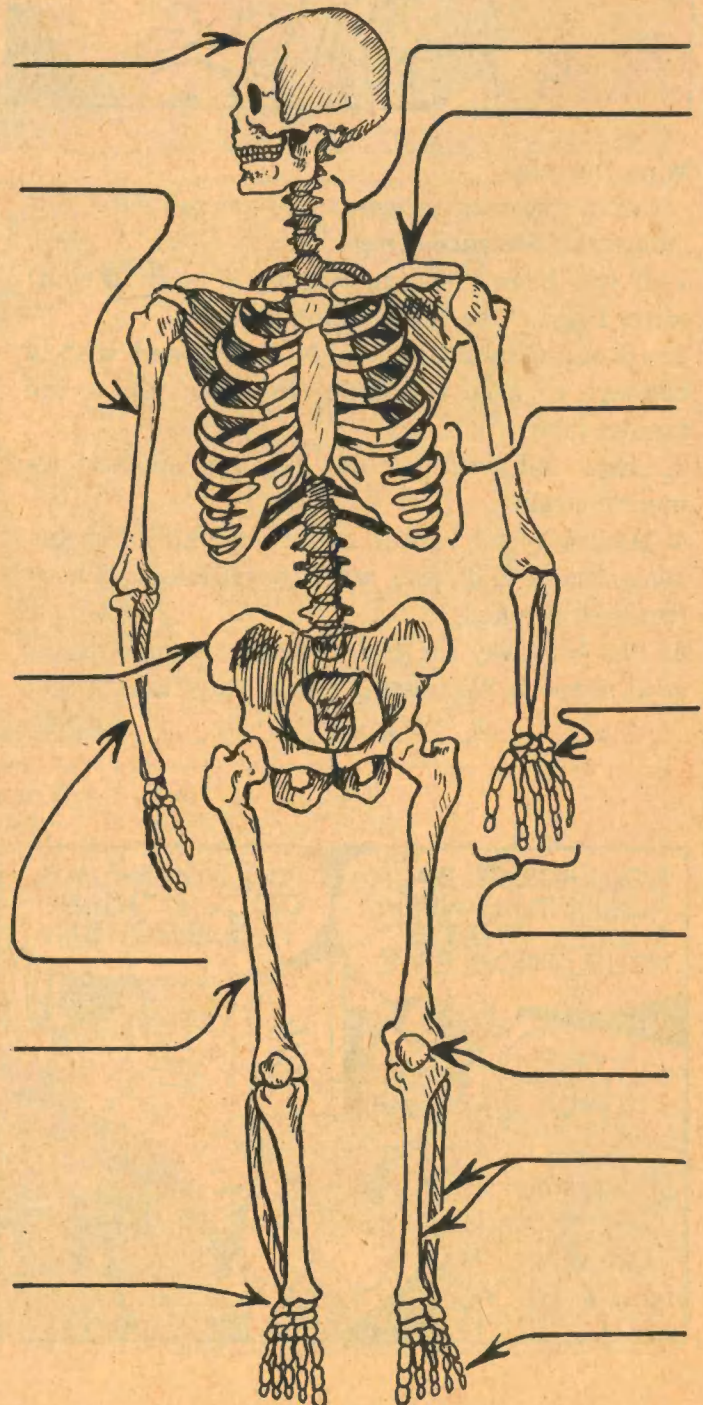




You don't have to play ball to suffer a dislocation. Too big a yawn will sometimes make your jaw slip out of joint. A sudden, hard blow on fingers, toes, or even a hip, and—zap—a bone may be knocked out of joint. The bones of the body all fit together like a machine. But when a bone is dislocated, the end of the bone has slipped out of its joint.

Usually a good, strong pull *by a doctor* will pop the bone back into place. Don't try to do it yourself. You might injure a bone ending. After the bone is back in its joint, you treat the injury like a sprain. At right the X ray shows a dislocation.

THE LIGAMENT AT THE LOWER THUMB JOINT HAS STRETCHED AND THE BONES ARE DISLOCATED.



#### How Many Bones Do You Know?

Look at Doc's skeleton on the right. Then write the names of the following bones in the correct blanks. Use a dictionary for those you don't know: *skull, ribs, ankle, vertebrae, fingers, thigh, forearm, toes, lower leg, collarbone, knee, hip, upper arm, wrist.*



# CHAPTER TWO

## THE DIGESTIVE SYSTEM

### HOW ARE THESE THREE PEOPLE ALIKE?



Speedy Suzie



Chowhound Chuck



Hot Stuff Howie

In what way are the three people above alike?

- A. They're all New York Giants football players.
- B. They're all top rock singers on TV.
- C. They're all very likely to have problems with their stomachs after eating.

Did you choose answer C? If you did, you're right. These three hungry food fans will probably join thousands of unhappy people who suffer from

stomach problems each day because of *what* and *how* they eat.

Stomachaches can be very painful. What's more, if something isn't done about the cause of the problem, it can lead to serious damage to the digestive system. Stomachaches may mean that your food is not being fully digested. Indigestion is a common cause of stomach problems. What causes indigestion? Most often it is caused by poor eating habits.



Take Speedy Suzie. Sue doesn't take time to chew her food enough. Food goes to her stomach only partly broken up. This means her stomach will have to work long and hard to do the job her teeth should have done.

It means more stomach acids will be needed to break down the large pieces of food she swallowed. This extra supply of acid could burn the walls of the stomach.

Because Sue eats so fast, she takes in a lot of air with her food. The air goes to her stomach along with her food. Then the air pushes against the walls of her stomach—trying to get out. This often causes pain and makes her burp.

Chowhound Chuck eats everything in sight. His stomach has to stretch to hold it all. Chuck gives

his stomach more work than it can handle. Food can't be digested fast enough. His stomach gets no rest. Before his stomach can digest the first load, Chuck stuffs it again. As with Suzie, an extra supply of stomach acid is needed to do the extra work.

Then there's Hot Stuff Howie. Spicy foods are his thing. Chili, onions, garlic, pepper. You name it. If it's hot, Howie loves it. But Howie's fun soon turns to fire—fire in his stomach that is hard to put out.

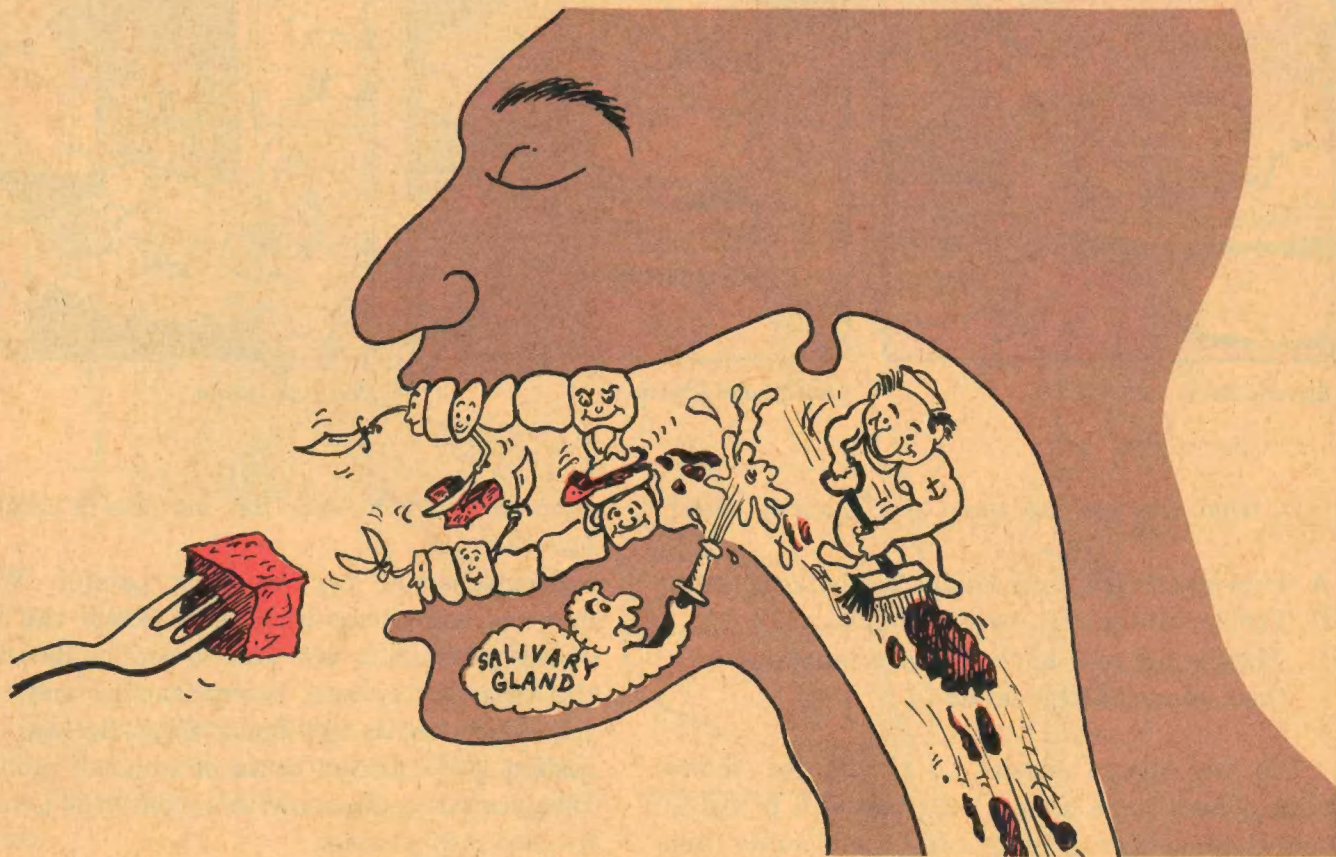
Howie's stomach sends extra acids to digest all the hot food. Both the acids and the hot stuff Howie loves burn the soft lining of his stomach. In no time at all, Howie feels like a balloon in pain, and water doesn't seem to help.

## LET'S TAKE A LOOK AT DIGESTION

Your digestive system works like an assembly line in a factory. Each part of the system does a job to break down (digest) the food you eat. Food enters your stomach as solids. As it travels along the assembly line, it is turned into a liquid. The liquid food is then carried off by the blood to feed all parts of the body. Food that cannot be

digested is passed off as waste.

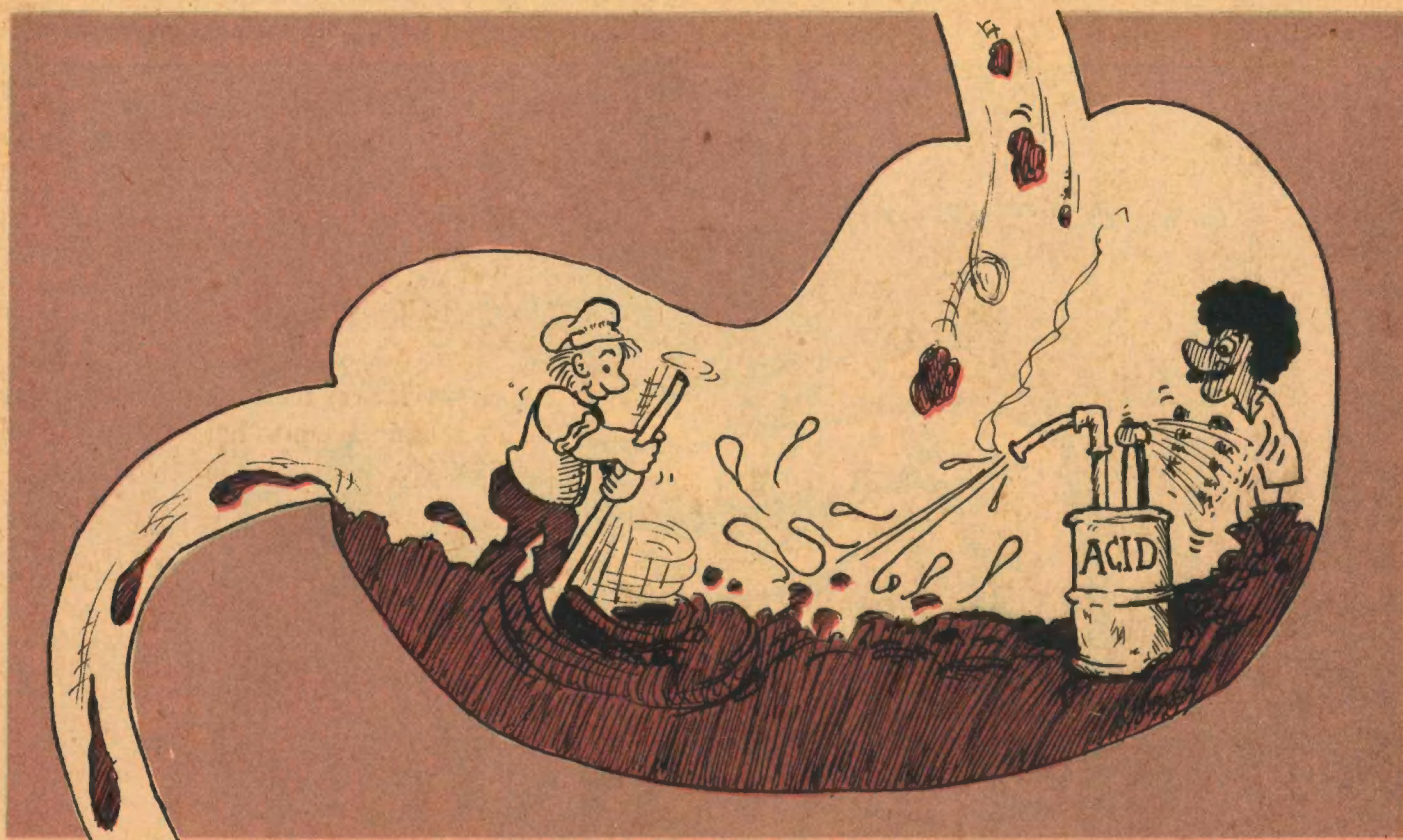
The first worker on this assembly line is the mouth. Chewing breaks up the food. Front teeth cut. Back teeth grind. Food is broken down into small pieces and mixed with saliva (spit). Then it's swallowed and travels down the throat to the stomach.





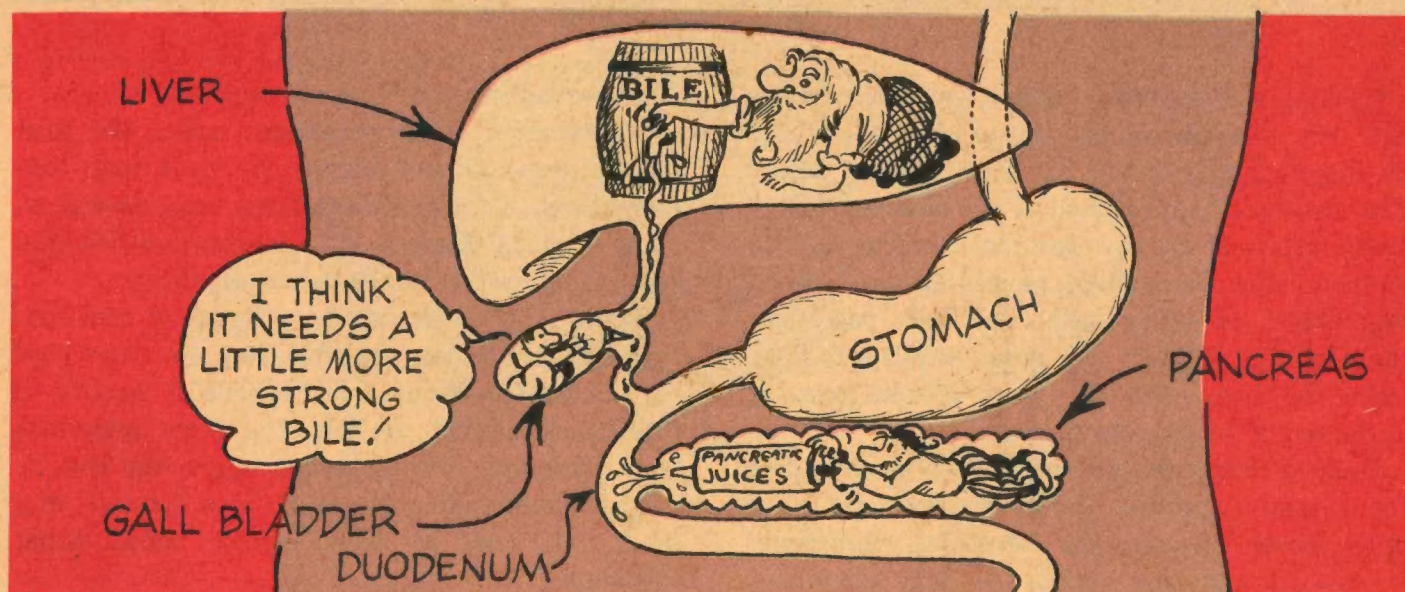
When food reaches the stomach, it is broken down even more. The stomach acts somewhat like a mixing bowl. The lining of the stomach gives

off juices and acids to aid digestion. These acids and juices mix with the food until it becomes like thick mush.



The mushlike food is then pushed out of the stomach and into a tube called the *duodenum* (dyoo-uh-DEE-nuhm). It is here that the biggest job of digestion takes place. Chemical juices are sent from other body parts to work on the food

here. A juice called *bile* comes from the *liver* and helps to digest fats like butter. The *gall bladder* stores bile for the liver to help digest fats. Juices from the *pancreas* (PAN-kree-uhs) speeds the digestion of starches.

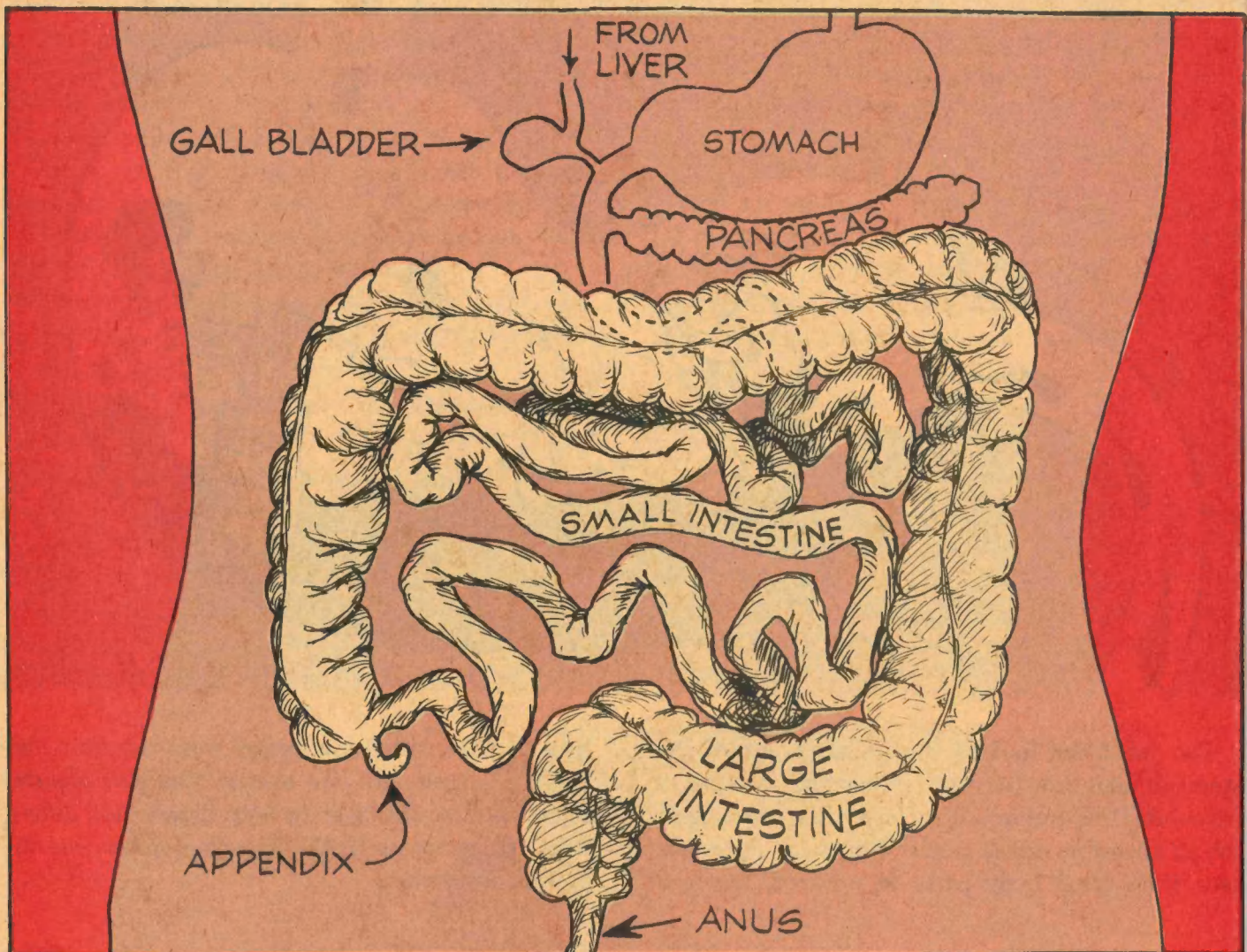




The food is now almost digested. Next it passes into the small intestines. Digestion is finished here. The food is now a liquid.

The lining of the small intestines is covered

with tiny hairlike growths (villi). These hairlike tubes soak up the liquid food and move it into the blood vessels. There the blood loads up and delivers the food throughout the body.



Looking at the drawing above, you may wonder why the large intestines are needed. If food is all digested, what is the purpose of larger tubes? The answer is that all food is not digested. Many foods (celery is a good example) have parts with no food value. These foods, mostly uncooked green vegetables, are called *bulk*. The body passes off these wastes through the large intestines. They leave the body through the *anus*—the opening at the end of the large intestines.

Bulk is important. It helps the body complete the digestive process. Solid wastes help push other wastes through the intestines. Sometimes wastes will not pass out of the large intestines.

Then we call this problem *constipation*.

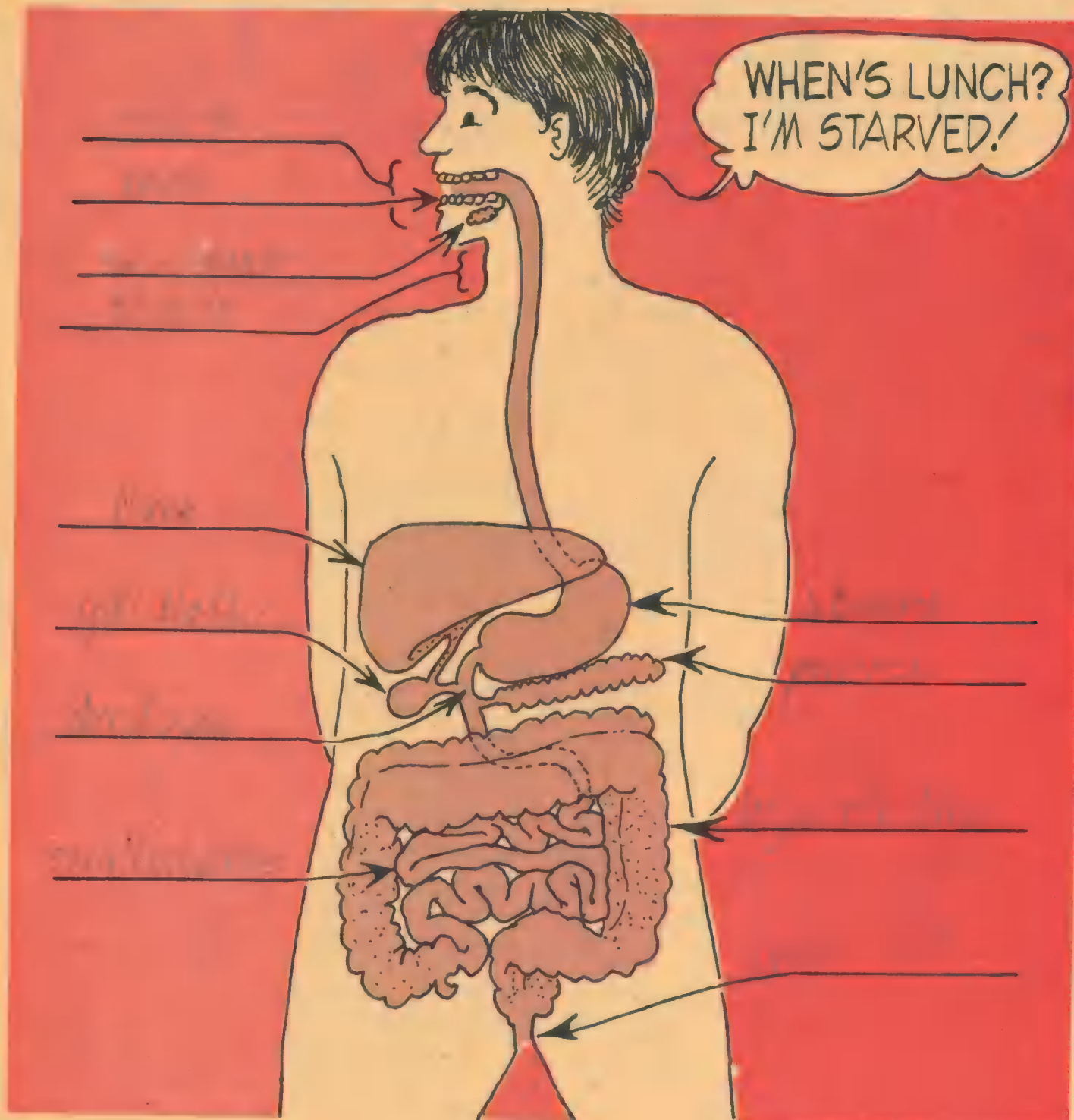
Constipation usually happens when the food we eat doesn't have enough bulk. It may also happen when the muscles of the large intestines become weak because of illness. Not drinking enough liquids can also cause constipation.

Often a headache can be a signal of constipation. Your intestines feel full, but you can't pass off the wastes. When this happens, a *laxative* is sometimes needed to help the large intestines work. Drinking lots of liquids helps too. But be careful about taking too much of a laxative, and don't take any at all if you're taking other medicine.



# HOW WELL DID YOU DIGEST THE SYSTEM?

In the drawing below, fill in the blanks on the digestive system with the following names: *pancreas, large intestines, stomach, mouth, teeth, throat, saliva glands, duodenum, gall bladder, liver, small intestines, anus.*





# A SMOOTH-RUNNING MACHINE

Your digestive system is like a smooth-running machine. But, like any machine, it needs care. If not treated right, your stomach can really give you trouble. Doctors say one out of every ten people has an *ulcer* at one time or another during his life.

An ulcer happens when the lining of your stomach or duodenum is eaten away by too much acid. Most of the time it is caused by nervousness. Poor eating habits can add to the problem. When a person gets an ulcer, a special diet is usually needed to cure it. Sometimes an operation is necessary.

So, to keep your digestive system running smoothly, here are some things to remember.

- Don't overeat.
- Chew your food well.
- Don't eat too many hot, spicy foods.
- Too much liquor can harm the lining of the digestive system.
- Smoking can cause tar and smoke to mix with saliva from the mouth. Too much of this mixture can hurt stomach lining.
- Avoid eating foods that you know will cause you indigestion.
- Frequent pains or gas in the stomach can mean other problems besides indigestion. Then a medical checkup is needed.

## WHICH DOES WHAT?

Column A below lists the names of the parts of the digestive system. Column B tells what each part does. Match them by putting the number of the name in Column A in the correct blank in Column B.

### Column A

1. liver
2. gall bladder
3. pancreas
4. stomach
5. mouth
6. teeth
7. duodenum
8. small intestines
9. large intestines
10. throat
11. villi
12. bulk
13. ulcer
14. digestion
15. constipation
16. anus

### Column B

- 5 cuts and grinds the food
- 8 mixes the food with digestive acids
- 9 passes off food wastes from the body
- 1 gives off juice that helps digest fats like butter
- 2 gives off juice that helps digest fats
- 3 gives off juice that helps digest starches
- 10 passageway from the mouth to the stomach
- 7 tube where most of the digestion takes place
- 6 tubes from which liquid food is passed into the blood
- 4 place where food is first mixed with a digestive juice called saliva
- 12 the parts of food that have no value and are passed off from the body as wastes
- 11 hairlike growths in the small intestines that pass liquid food to the blood
- 15 problem in the large intestines when wastes will not pass out of the body
- 13 problem where the lining of the stomach or duodenum is eaten away by strong acids
- 14 breaking down food from solid form into a liquid form that can be used by the body
- 16 opening at the end of the large intestines



# A LIFESAVING BEAR HUG



Have you ever choked on your food? Most people have. Choking on food is more serious than most people think. Doctors say that about 4,000 people die each year from choking on food.

People choke when a piece of food gets stuck in the windpipe. Air can't get to the lungs. If the food isn't removed, the person may die within minutes.

Suppose you were eating with the group above. Would you hit the choking girl on the back? Give her a big bear hug? Run away to look for a doctor?

Doctors used to think the best way to help a choking person was to slap the person on the back. But now doctors have found a better way—a way that's easy for anyone to do.

## Some Thoughts for Discussion . . .

1. What are some of the foods that upset your stomach?
2. What can you do about indigestion once you get it? What remedies for indigestion does your family use?
3. Many young people get ulcers. Is there anyone in your class with an ulcer? What kind of a diet is needed to cure it?
4. What are some of the foods you think would be easiest to digest? hardest?
5. Is there anyone in your class who has choked on food? What was done about it?



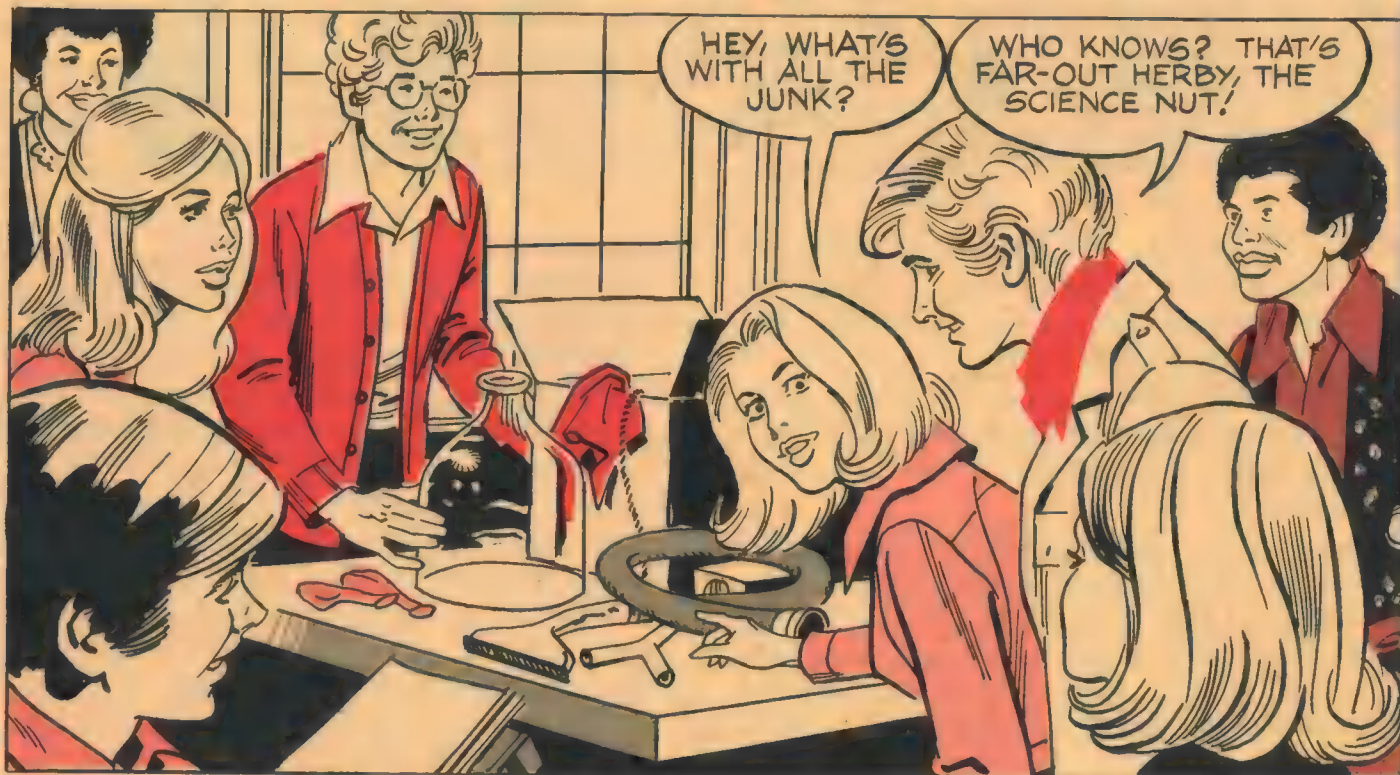
The hard squeeze forces air from the lungs. The air blows the piece of trapped food out of the throat. Practice this hug on a friend. Someday you may be able to save a life.



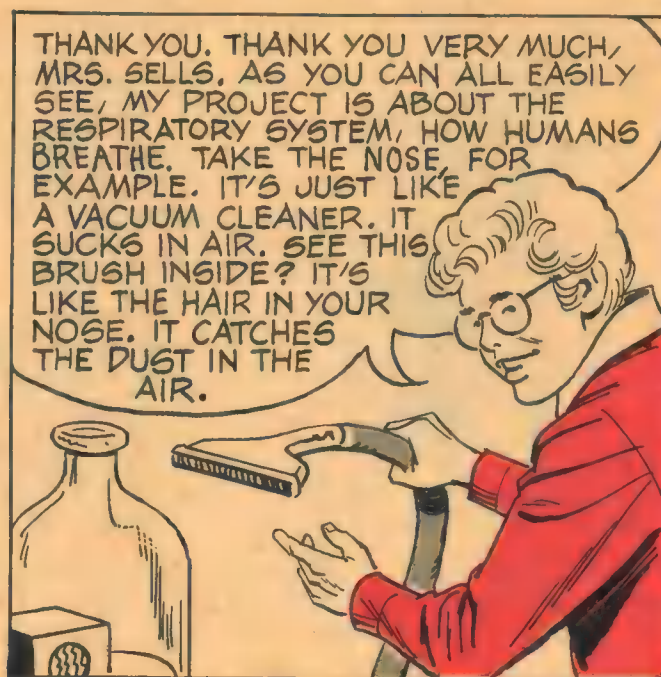
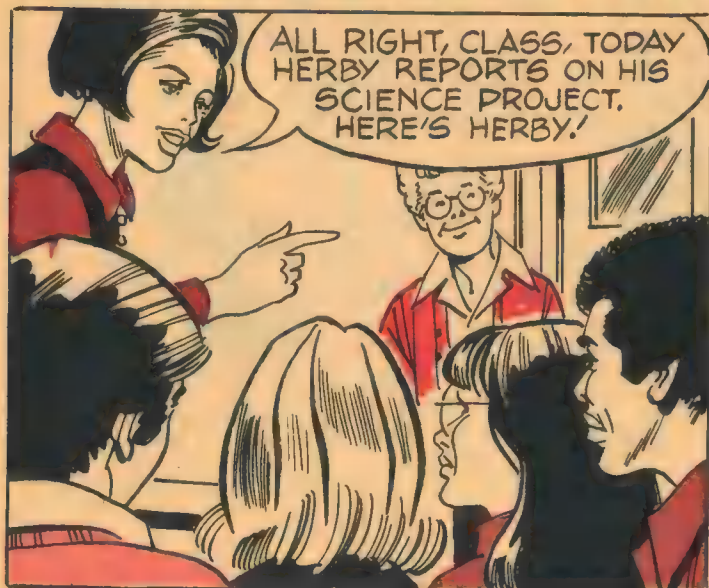
# CHAPTER THREE

## THE RESPIRATORY SYSTEM

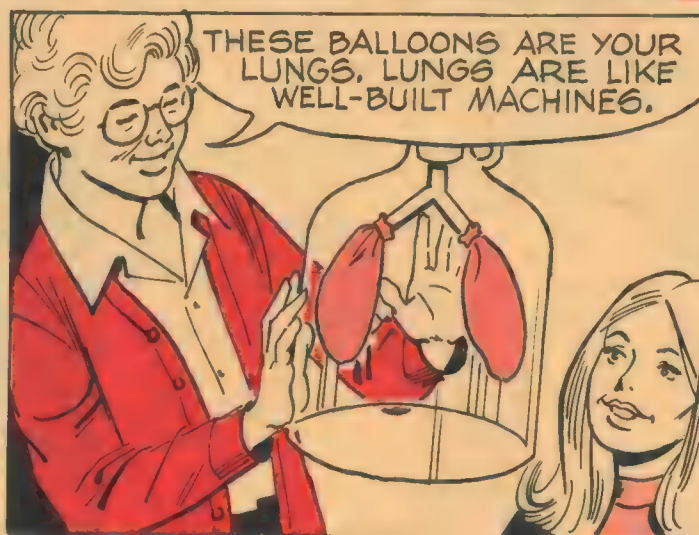
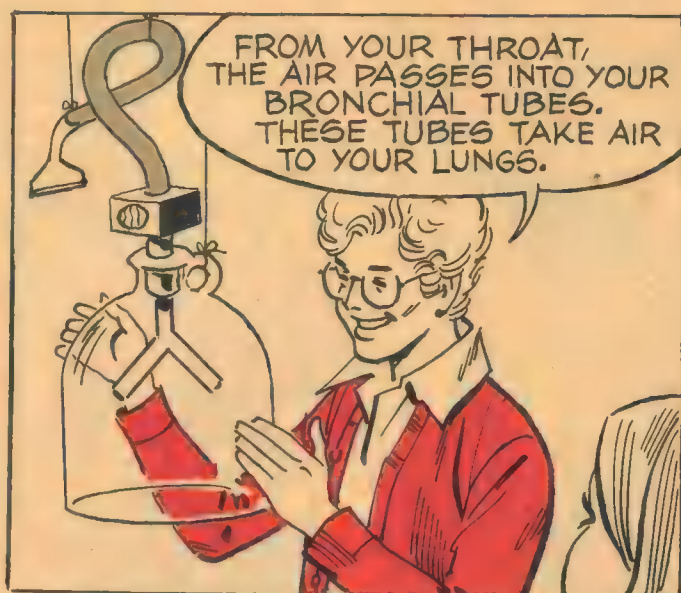
### HERB'S SCIENCE PROJECT



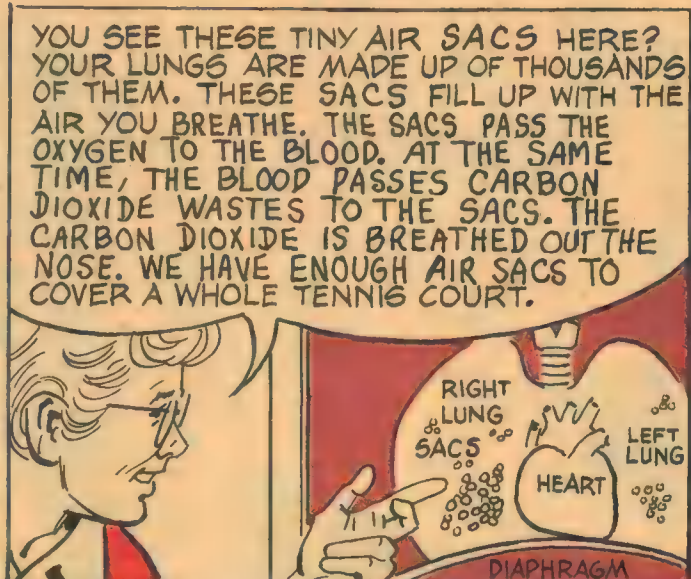
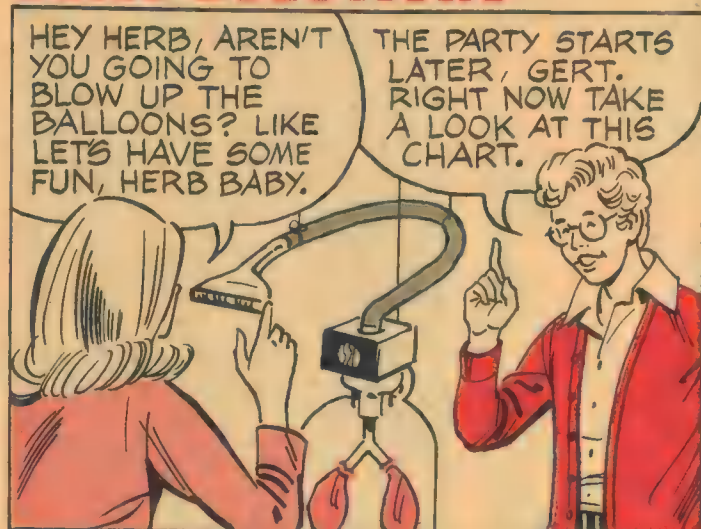
### HERB TAKES THE FLOOR







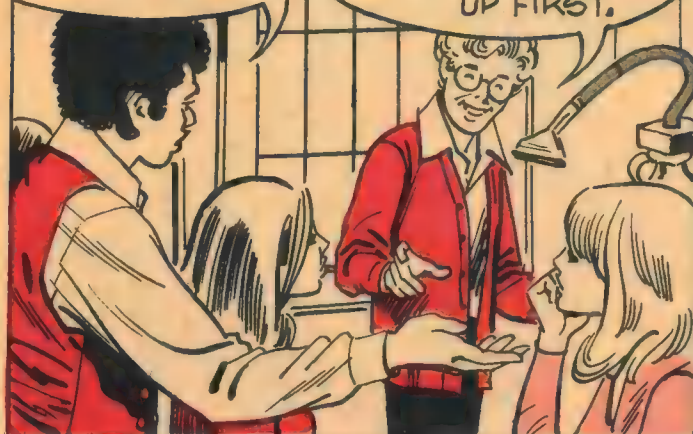
## HERB GETS SOME QUESTIONS



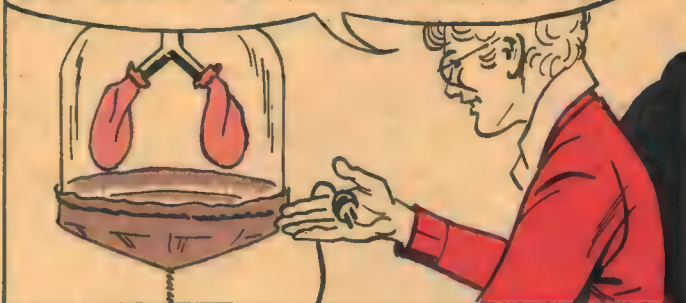


OK, HERB, I FOLLOW YOU SO FAR. BUT WHAT MAKES THE LUNGS WORK?

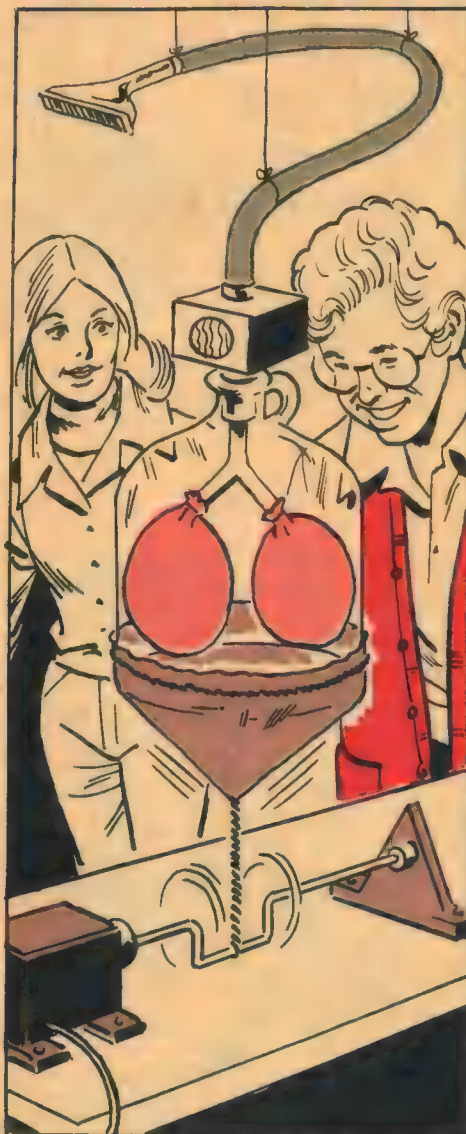
THESE ARE A FEW MORE PARTS TO MY PROJECT. LET ME HOOK THEM UP FIRST.



THIS RUBBER SHEET IS LIKE YOUR DIAPHRAGM. THE BALLOONS ARE LIKE YOUR LUNGS. WHEN THE MOTOR PULLS THE RUBBER SHEET DOWN, THE BALLOONS FILL WITH AIR. THEN WHEN THE RUBBER SHEET GOES UP, THE AIR IN THE BALLOONS IS PUSHED OUT. JUST LET ME PLUG THIS MOTOR IN HERE, AND I'LL SHOW YOU HOW IT ALL WORKS.



## HERB PLUGS IT IN

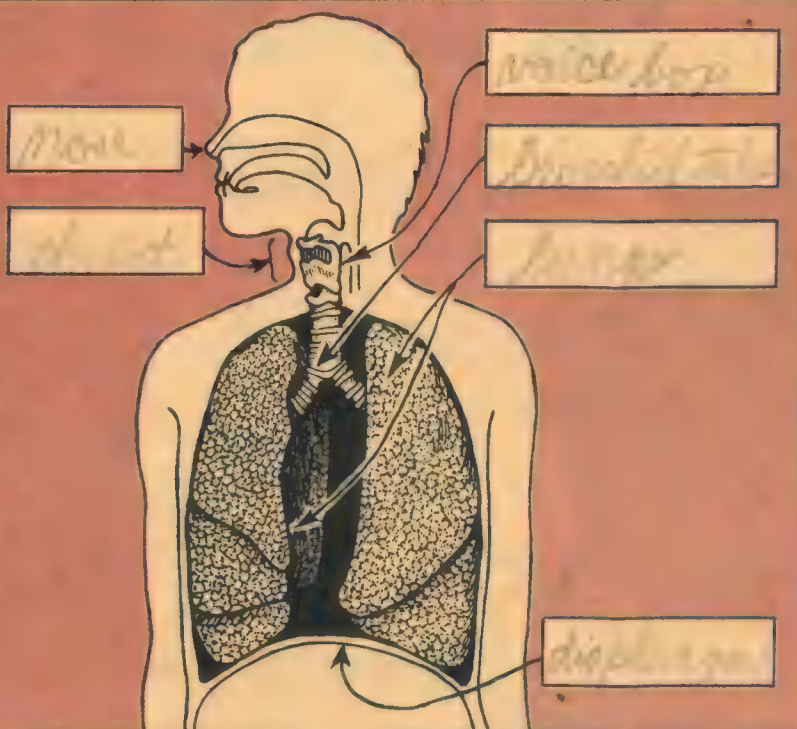
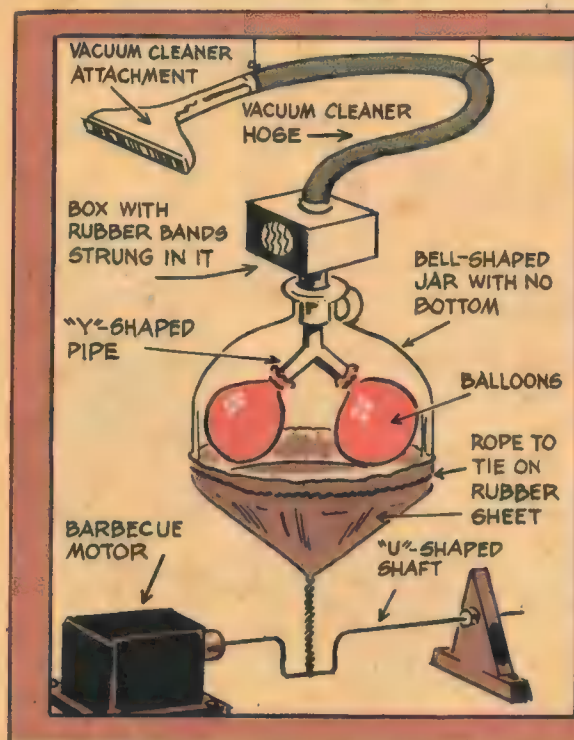


OH, WELL, SO MUCH FOR THE RESPIRATORY SYSTEM!

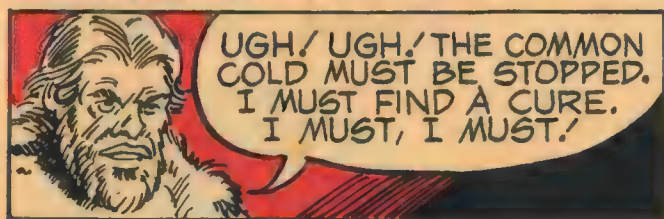


What kind of teacher was Herb? Can you name the parts of the respiratory system? Use Herb's project on the left to compare with the body's

system. Write the following names in the correct boxes: *diaphragm*, *voice box*, *nose*, *bronchial tubes*, *lungs*, *throat*.



## CARING FOR YOUR MACHINERY



Colds are a medical mystery. Doctors have developed medicines to help with the effects of a cold. There are medicines for runny noses, for coughs, for cold pains. But doctors have never found a way to cure the common cold.

Doctors warn that colds may lead to worse sicknesses. Taking care of yourself when you have a cold is important. Here are some things doctors advise when you get a cold:

- Bedrest is the best help for a cold. Staying in bed keeps you away from others so the cold germs don't spread. Your body needs rest to fight the cold germs.



- Drink plenty of liquids like water and fruit juices. Liquids are needed by the body to help get rid of wastes.
- Aspirin will help ease headaches that often come with a cold.
- Cough medicines can help a dry throat and stop the coughing.

Your body may be its own best doctor. Colds usually go away in a few days if you take care of them. But colds are caused by germs that infect parts of the respiratory system. If the body hasn't cured the cold in three or four days, you might have a very bad infection. If so, see a doctor.



# CHAPTER FOUR THE CIRCULATORY SYSTEM

## A TRANSPORTATION MOVIE





# A TRANSPORTATION WORKER SPEAKS

GOOD EVENING, FOLKS. THIS IS YOUR ON-THE-SPOT REPORTER, WALTER KRUMKITE, WITH ANOTHER UNUSUAL INTERVIEW.



TONIGHT WE ARE ON THE LIFE LINE THRUWAY WHERE TRAFFIC IS REALLY HEAVY. WE ARE GOING TO INTERVIEW... AH... HERE COMES ONE NOW.



EXCUSE ME, SIR. WOULD YOU MIND ANSWERING A FEW QUESTIONS FOR OUR MILLIONS OF FANS OUT THERE IN HEARTLAND, U.S.A.?



HEY, YOU'RE WALTER KRUMKITE, AREN'T YOU? OK, KRUM. ASK ME ANYTHING. BUT MAKE IT FAST. WE BLOOD CELLS MAKE TWO ROUND TRIPS THROUGH THE BODY EVERY MINUTE. THAT'S TWO TRIPS A MINUTE, BROTHER.



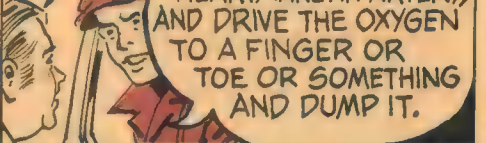
HEY, YOU ARE FAST.

NO, I'M RED. RED CELL IS WHAT THEY CALL ME, KRUM.



WELL, RED. WOULD YOU MIND TELLING OUR FANS OUT THERE IN TV LAND EXACTLY WHAT YOU DO?

I WORK, MAN. I DRIVE UP THROUGH THE LUNGS AND PICK UP A LOAD OF OXYGEN. THEN I PASS THROUGH THE HEART, TAKE AN ARTERY, AND DRIVE THE OXYGEN TO A FINGER OR TOE OR SOMETHING AND DUMP IT.



WHERE DO YOU GO FROM THERE?

I LOAD UP AGAIN-- ONLY THIS TIME WITH WASTES-- STUFF THE BODY WANTS TO GET RID OF-- LIKE CARBON DIOXIDE. THEN I HOP ON A VEIN AND HEAD BACK TO THE HEART.



WELL, RED, YOU SURE KEEP BUSY.

BUSY. LISTEN, KRUM. WE RED CELLS WORK OURSELVES TO DEATH. THREE WEEKS-- THAT'S HOW LONG WE LAST. THREE WEEKS. THEN NEW RED CELLS COME ALONG AND TAKE OUR PLACE. WHAT WE NEED IS A GOOD LABOR UNION.



NEW CELLS? WHERE DO THEY COME FROM?

BONES. NEW CELLS ARE MADE INSIDE THE BONES. WHEN WE RED CELLS DIE AFTER THREE WEEKS, WE PASS OUT OF THE BODY AS WASTE. GONE AND WHO CARES?



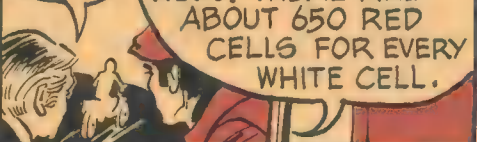
WE ALL CARE, RED. SAY, WHO ARE THOSE WHITE CATS SPEEDING BY?

THEM? THEY'RE THE LAW AND ORDER MEN. THEY FIGHT GERMS, HELP HEAL CUTS AND OTHER INJURIES TO THE BODY.



THERE DON'T SEEM TO BE VERY MANY WHITE CELLS.

THEY'RE ALL OUT PATROLLING. THEY TRAVEL THROUGH THE ARTERIES AND VEINS LOOKING FOR TROUBLE SPOTS. BUT YOU'RE RIGHT. THERE AREN'T AS MANY WHITES AS REDS. THERE ARE ABOUT 650 RED CELLS FOR EVERY WHITE CELL.

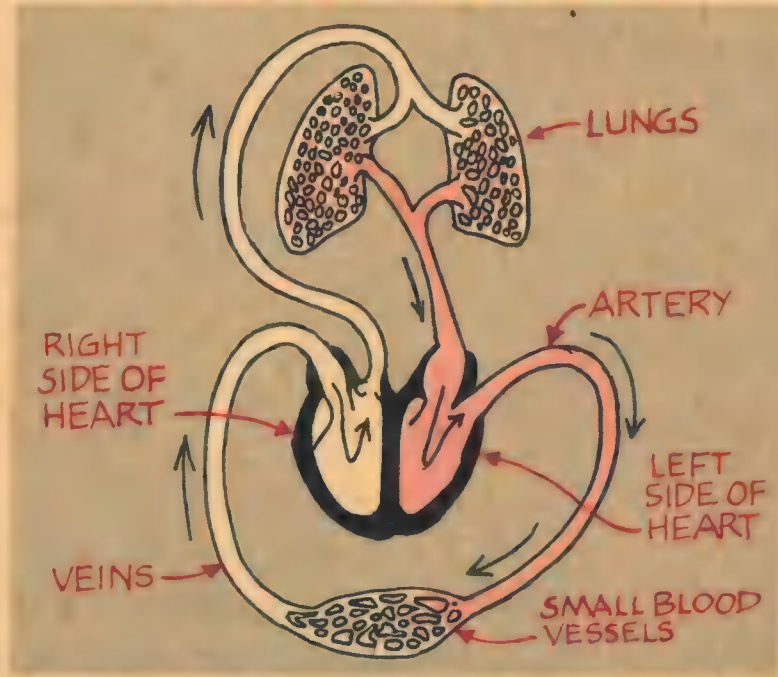


I SEE OUR TIME IS UP, RED. THANKS A LOT-- AND KEEP TRUCKIN'. THIS IS WALTER KRUMKITE SAYING GOOD-NIGHT AND GOOD LUCK.





# TWO PUMPS IN ONE



The heart works like two pumps in one.

Thump, thump. Thump, thump. Hour after hour. Day after day the heart thumps its way through life. The average heart beats about 72 times every minute. With each beat new blood carries food and oxygen to body parts.

Each beat of the heart means a new supply of blood (two ounces) is being pumped through the body. Blood starts its journey by being pumped from the left side of the heart into the body's largest artery. The blood travels through the artery to smaller and smaller blood vessels. In this way all parts of the body get a supply of oxygen.

The blood then picks up wastes such as carbon

dioxide and returns to the heart by way of the veins. These blood cells are now a dull red because they have no oxygen. The blood cells then enter the heart from the right side (see drawing).

The heart beats. The blood carrying the waste is pumped out of the heart and into the lung. Here the blood leaves its waste and picks up a new supply of oxygen. It then returns to the left side of the heart to start its trip all over again. A complete trip takes about 30 seconds.

The drawing shows that the blood travels in two different circles. The heart is really two pumps in one.

## How Much Do You Know About the Blood?

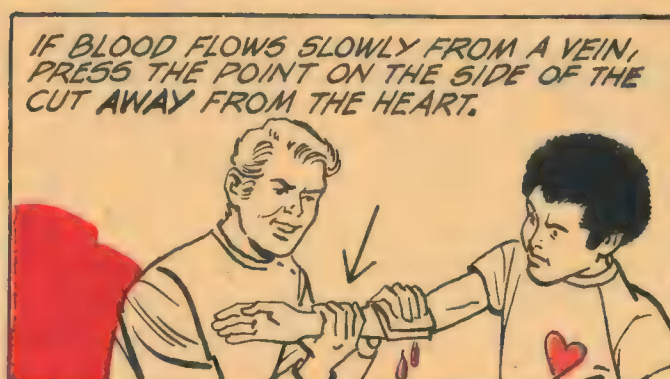
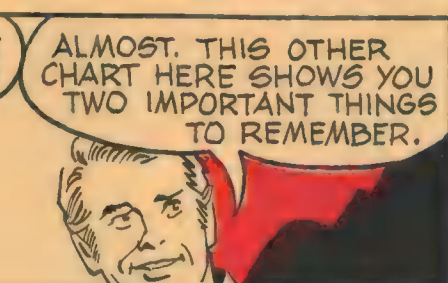
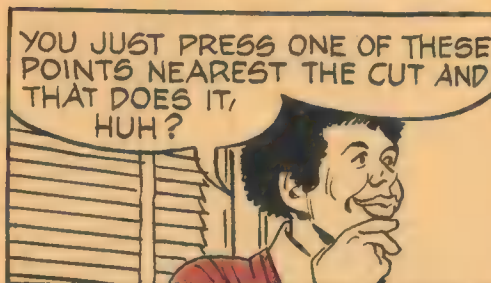
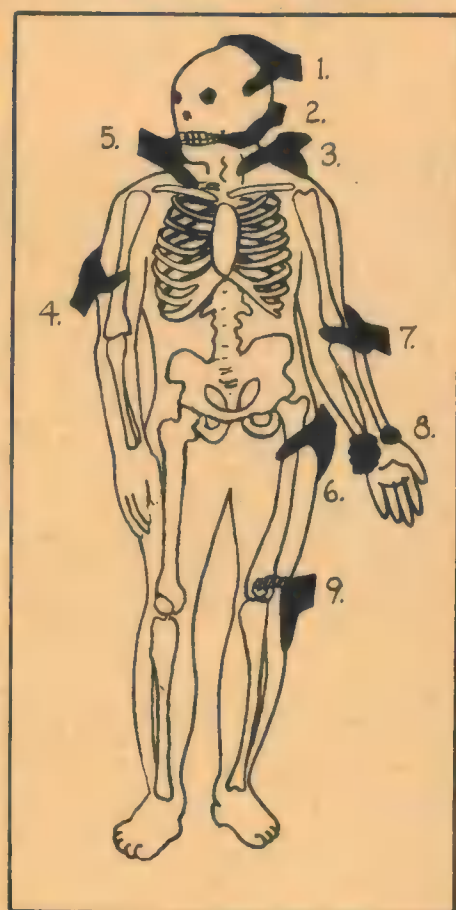
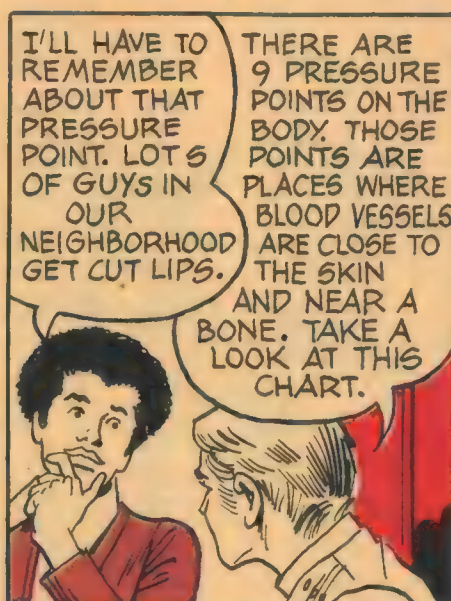
Mark **T** for True and **F** for False in front of the following sentences.

- \_\_\_ 1. White cells outnumber red cells.
- \_\_\_ 2. Red cells travel along arteries to carry oxygen to body parts.
- \_\_\_ 3. White cells carry wastes out of the body.
- \_\_\_ 4. White cells fight germs in the blood.
- \_\_\_ 5. White cells help heal cuts and scratches.
- \_\_\_ 6. Blood cells only live a few minutes.
- \_\_\_ 7. Blood cells are made inside the bones.

- \_\_\_ 8. Blood vessels that carry blood back to the heart are called veins.
- \_\_\_ 9. The heart's biggest job is to pump blood.
- \_\_\_ 10. The heart pumps about 72 times in a minute.
- \_\_\_ 11. Waste and carbon dioxide are carried away from body parts in the veins.
- \_\_\_ 12. Blood picks up oxygen in the heart.
- \_\_\_ 13. Blood in the arteries is a brighter color than blood in the veins because it has oxygen.



# PRESSURE POINTS



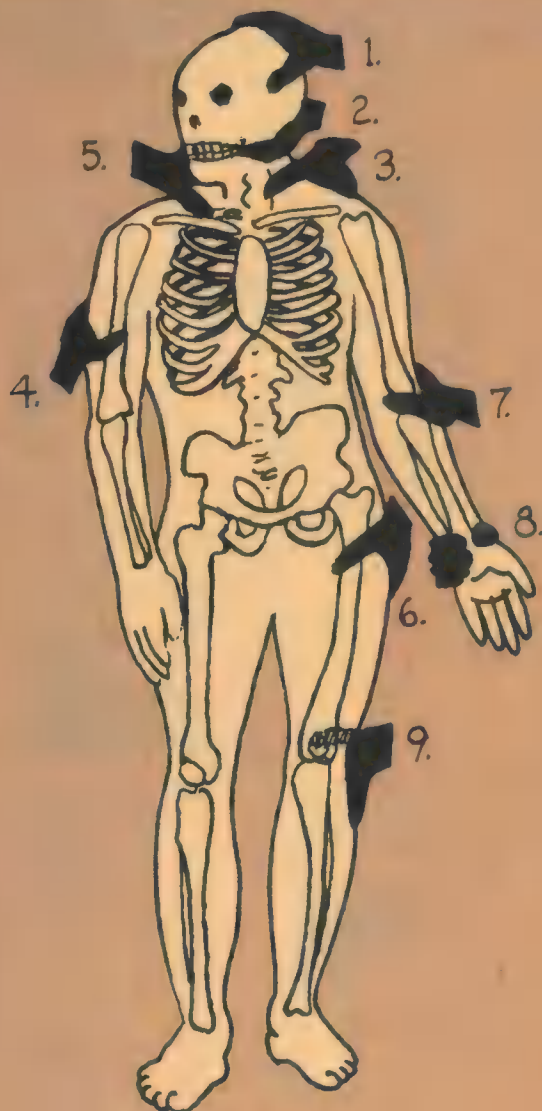


# PRESSURE PRACTICE

Using the chart below, decide which pressure point will stop blood flow if an artery is cut in the following places. (Use numbers of the pressure point to indicate answers.)

To stop blood flow from a cut ...

- a. behind the ear, press point \_\_\_\_\_.
- b. on the shoulder, press point \_\_\_\_\_.
- c. on the hand, press point \_\_\_\_\_.
- d. on the lower leg, press point \_\_\_\_\_.
- e. on the lower arm, press point \_\_\_\_\_.
- f. on the eyebrow, press point \_\_\_\_\_.
- g. on the lip, press point \_\_\_\_\_.
- h. at the elbow, press point \_\_\_\_\_.
- i. on the upper leg, press point \_\_\_\_\_.
- j. on the foot, press point \_\_\_\_\_.

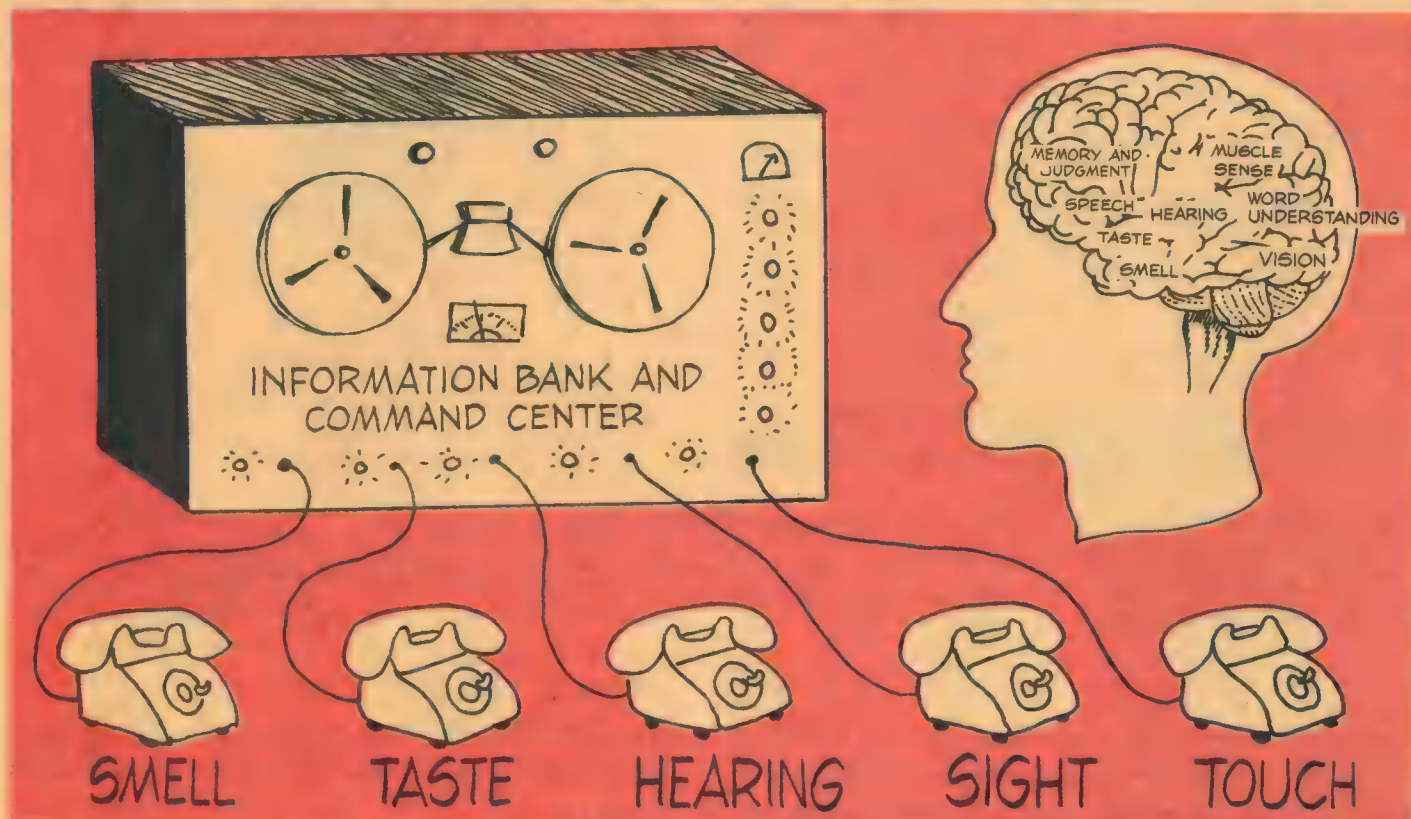




# CHAPTER FIVE

## THE NERVOUS SYSTEM

### THE BRAIN ... A CENTRAL OFFICE



Protected by the bony covering of the head is one of the greatest machines on earth—your brain. The brain is much like a computer and a telephone switchboard rolled into one.

Like the computer, it receives information from many sources. The five senses of the body—sight, hearing, touch, smell, and taste—constantly send information to the brain. The brain matches this new information to past information stored in the memory. This is how the brain understands the meaning of information sent to it by the senses. This is how the brain uses information to solve all kinds of problems.

The brain is also like a telephone switchboard at an Army general's office. It sends out orders to body parts to do different jobs. For example, your eyes may tell the brain that a baseball is headed

toward you. It's going to hit you right in the head.

Quickly, the brain orders your muscles to pull up your arm and hand to protect your face. Your eyelid is ordered to close. Your neck muscles are told to jerk your head out of the way. The ball misses, thanks to the brain.

The two-way messages between your brain and the body parts are sent over nerves. Nerves are like wires to an electric light. Messages to and from the brain travel on these nerves just like electricity through wires—fast, very fast!

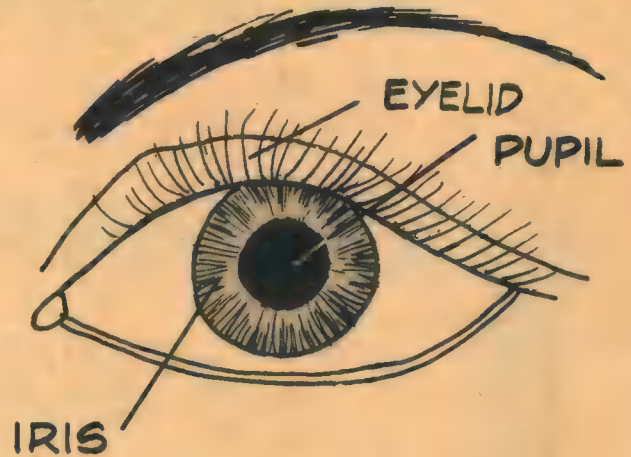
As you can see, the brain depends upon the body's five senses to send it information. If any of these senses do not work well for any reason, then the brain may have trouble doing its job. Let's take a look at these five senses and some of the problems they might have.



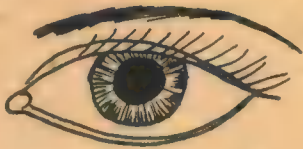
# THE EYES ... NUMBER ONE SENSE

Each part of your eye does a different job. But these parts work together to control the amount of light entering the *pupil*. The pupil is that small black circle in the middle of your eye. It's really a tiny hole. Its job is to let light into the eye. In order for the brain to receive clear pictures from the eye, the light must be just right.

In a dark movie theater, the eye needs more light to see clearly. Here, the *iris* does its job. The iris is really a muscle. It's the part of your eye that is colored. If you have blue eyes, then the iris is blue. In the darkness, the iris pulls the pupil open to let in more light. Then the eye looks like this:



Your eye works very much like the lens of a camera.



On a bright, sunny beach, light is strong. So the iris closes the pupil until your view is clear. Then the eyes look like this:

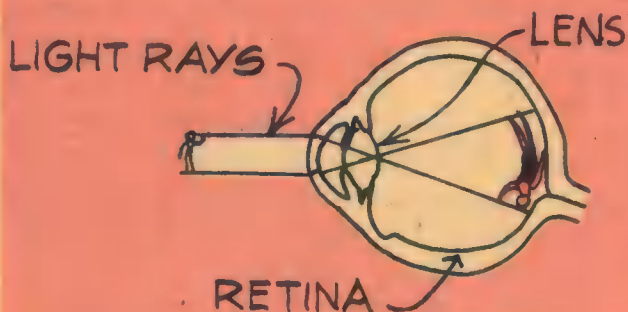


The *lens* is another important part of the eye. It's found behind the iris and the pupil. The lens acts just like a curved piece of glass. The lens's job is to direct light rays coming into the eye so that the angle of light rays brings in a clear picture of the image you are looking at.

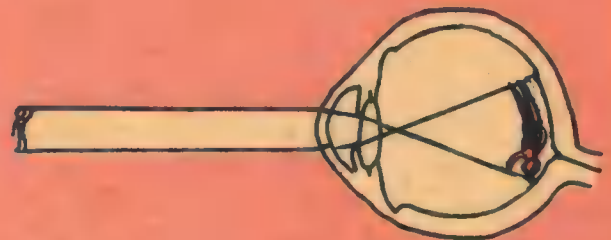
Muscles of the eyeball pull or push the lens so that its curve changes. When the curve of the lens changes, then the angle of light rays entering the

pupil changes too. This helps the eye to get clear pictures of images close up as well as those at a distance.

Light rays entering the pupil travel to the back of the eyeball. There the image seen is projected on the *retina*—a curved surface something like a movie screen. If light rays do not hit the retina just right, the picture will not be clear. See the drawing below.



The lens is more curved when looking at closeup things.



Seeing far-off things requires a flatter curve in the lens.



# WHAT DID YOU SAY?

During wartime, many soldiers began to have hearing problems. The reason—loud noises from big guns caused damage to parts of their hearing machine. But it doesn't take a war to damage hearing. Today, many people suffer damage to their hearing because of other kinds of noises.

The clang, clang, clang heard in some factories can do it. The roar of jet planes might too. And the boom, boom, boom of a way-out rock band can also be responsible for ear damage.

Loud noises cause more hearing problems than many people think. Damage to the tiny parts of the hearing machine is often caused by powerful sound waves beating through the ears.



## THREE EARS IN ONE

### The Outer Ear

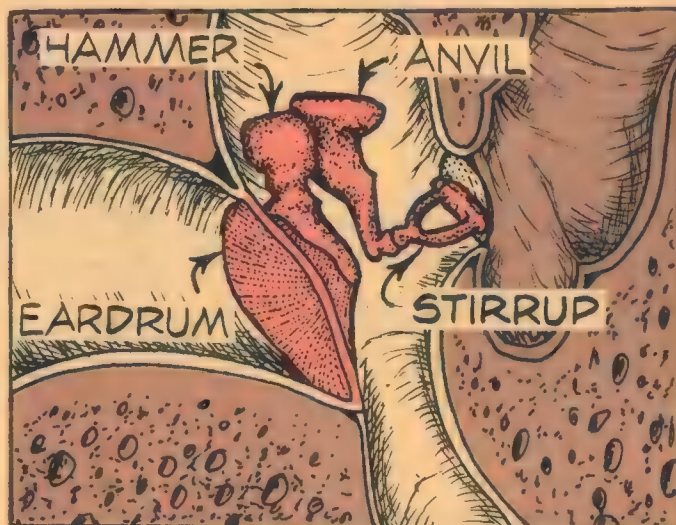
Sound travels in waves through the air. The *outer ear* catches the sound waves and directs them into the *ear canal* (see picture). A piece of thin skin is stretched across one end of the ear canal. When sound waves hit this skin, it moves much like the head of a drum. That's why it's called the *eardrum*. The eardrum strengthens the sound waves as it moves back and forth. Then the eardrum passes the strengthened waves of sound on to the parts of the *middle ear*.



### The Middle Ear

The middle ear is made up of three tiny bones about the size of a pea. The bones are joined together in such a way that when one moves, they all move.

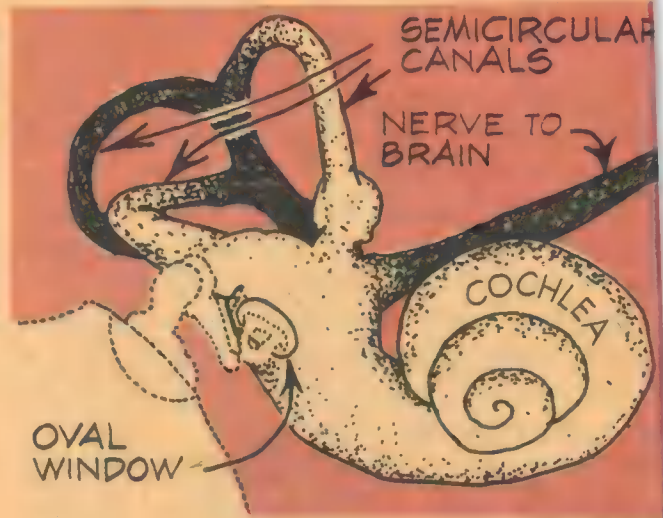
The first bone is called the *hammer* because of its shape. It's joined to the eardrum. When the drum moves, the hammer does too. It takes the sound movement (vibration) from the eardrum and passes it along to the second bone, the *anvil*. Then the anvil passes the vibration on to the *stirrup*. Because of their shapes and the way they are joined together, these three bones make sound vibrations stronger as they pass them along.





## The Inner Ear

The snail-like shell of the inner ear is filled with a liquid. This shell is called the *cochlea* (KOH-klee-uh). The liquid in the cochlea receives the sound vibrations from the stirrups. Then, as the vibrations spread through the liquid, tiny hairs send the vibrations to the brain through nerves. The brain matches the vibrations to vibrations it has received in the past. In that way, the ear helps us know the meaning of sounds we hear.



## EAR PROBLEMS ... WHAT TO DO

Earaches and colds are the most common problems that bother the ear. To protect your ears and your hearing, here are a few things to remember:

- Keep your ears clean. Soap and water usually do the job. Dirt in the ears can cause infection. The sticky wax in the ear can cause dirt to build up on the eardrum. Then it won't vibrate as it should and sound waves won't be passed on correctly.
- Don't stick things in your ears, and never use a sharp, pointed object to clean wax from your ears. You might damage the eardrum.
- Blowing the nose hard sometimes forces matter up into the middle ear. This can prevent the

three tiny bones from doing their jobs. Take it easy when you blow your nose.

- Hard ear wax that won't wash out should be removed by a doctor. Sometimes warm mineral oil will soften the wax so it can be easily washed away.
- Put warm mineral oil in the ear to ease itching and pain caused by infection from colds.
- Don't expose your ears to loud noises for long periods of time.
- If you have trouble hearing high or low sounds, have your hearing checked. Sometimes hearing tests are given at school. Check with the school nurse.

## EYES & EARS ... HOW MUCH DO YOU REMEMBER?

Using T for True and F for False, mark the following sentences.

- |   |   |
|---|---|
| ___ 1. The pupil of the eye is the muscle that opens and closes the cornea.       | ___ 6. Loud music can damage your hearing machinery.                            |
| ___ 2. The lens is the part of the eye that works like a curved piece of glass.   | ___ 7. The hammer, anvil, and stirrup are large bones of the inner ear.         |
| ___ 3. The iris of the eye is the part that gives color to your eye.              | ___ 8. The cochlea is a snail-like shell filled with fluid.                     |
| ___ 4. The retina is something like a movie theater.                              | ___ 9. The eyes and ears send messages to the brain nerves like electric wires. |
| ___ 5. The curve of the lens makes light rays enter the eye at the correct angle. | ___ 10. The eardrum passes sound waves to the middle ear bones.                 |



# THE BODY POLICE... SMELL, TASTE, TOUCH



Recognize the VIP (Very Important Person) in the drawing? It's you. Those three policemen are your senses of smell, taste, and touch. They're

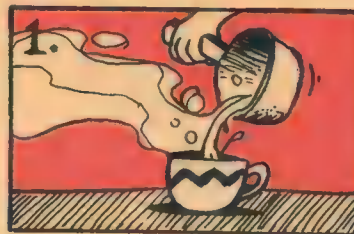
top watchmen and bodyguards that protect you. They pass along information to the brain that keeps your body comfortable and safe from harm.





Your nose is a real pal. It sends your brain information about what is happening around you. Fires, animals, foods, chemicals, plants, and people all have different smells. Some of them are pleasant and some of them are not. But each smell means something to the brain.

Sometimes colds keep your nose from doing its work. A runny nose or one that is stopped up doesn't work well. Besides, it's a bother. The next time you are bothered with a cold in your nose, try this:



Fill a cup with boiling water.



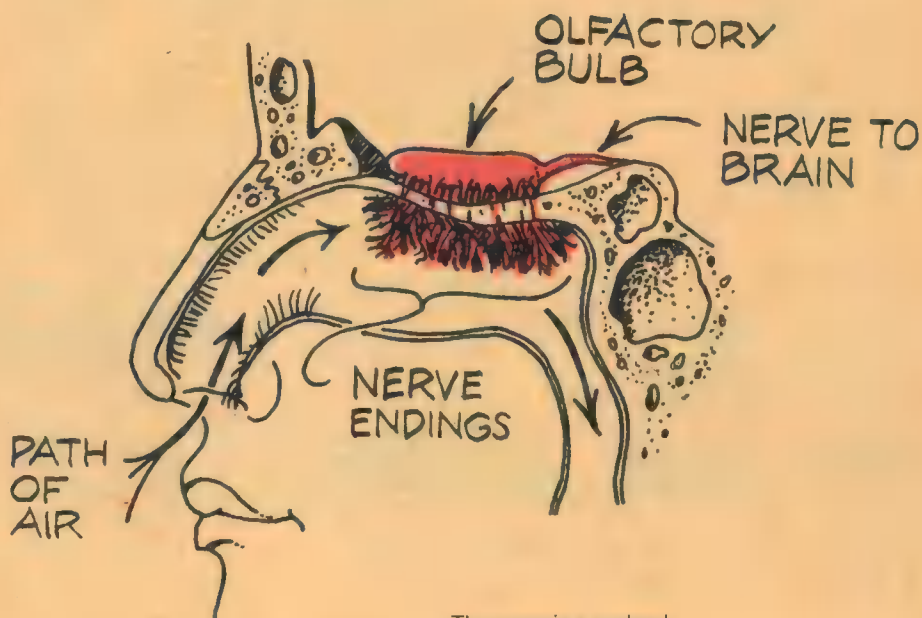
Put it in a teaspoon of eucalyptus oil or Vicks. Your drugstore has both.



Breathe the vapors from the cup.

## THE NOSE KNOWS, OR DOES IT?

If your nose is in good working order, it does other jobs besides just smelling. The hair inside the nose keeps dirt in the air from getting into the lungs. Blood vessels in your nose warm cold air as it passes through. Your nose passes on smells to the brain, and the brain can match them with smell messages received in the past. In this way, the brain is warned by the nose about things that may be bad for the body.



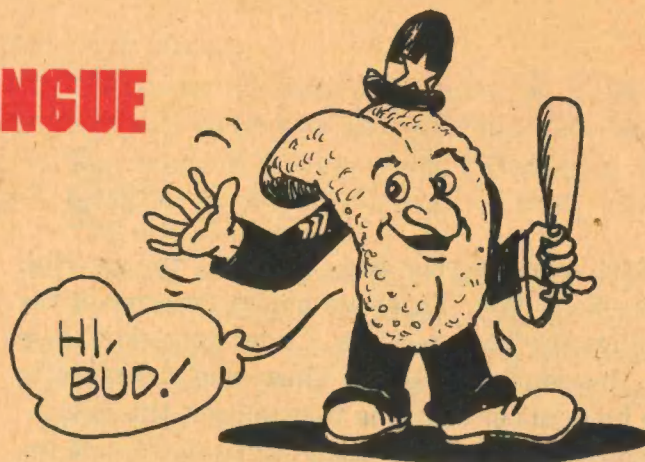
The nose is a real pal.



# IN GOOD TASTE... THE TONGUE

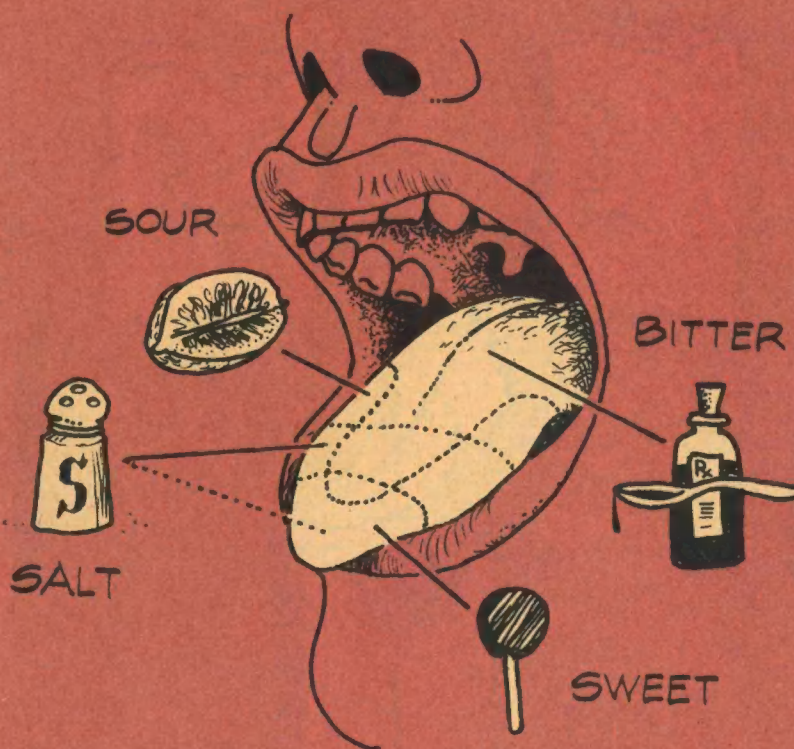
Take a look at your tongue in the mirror. See all those little bumps? They're taste buds. You have over 3,000 taste buds on your tongue. Each is connected to a nerve that carries messages to the brain about what you have in your mouth.

Different parts of the tongue report to the brain on different tastes. In the drawing below, you can see where the different tastes are received on the tongue.



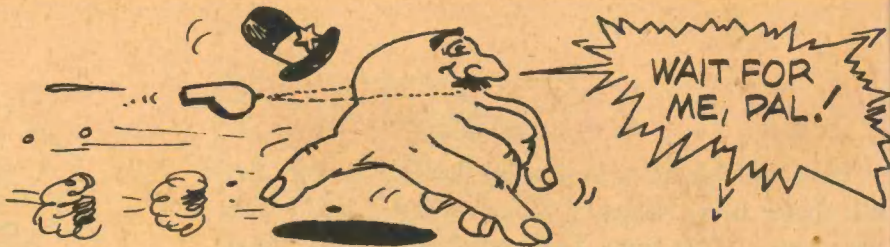
## DULL BUDS

Smoking and alcohol can dull the taste buds. A heavy cold can also make your food seem tasteless. Too much of any one kind of food or drink, hot or cold, sweet, sour, or spicy, can dull your taste buds and make food eaten later taste different for a few minutes. That's because the taste buds are full of one taste. It takes awhile for other tastes to become clear to the brain. Try eating an orange right after candy. What does it taste like?





# TOUCH SIGNALS

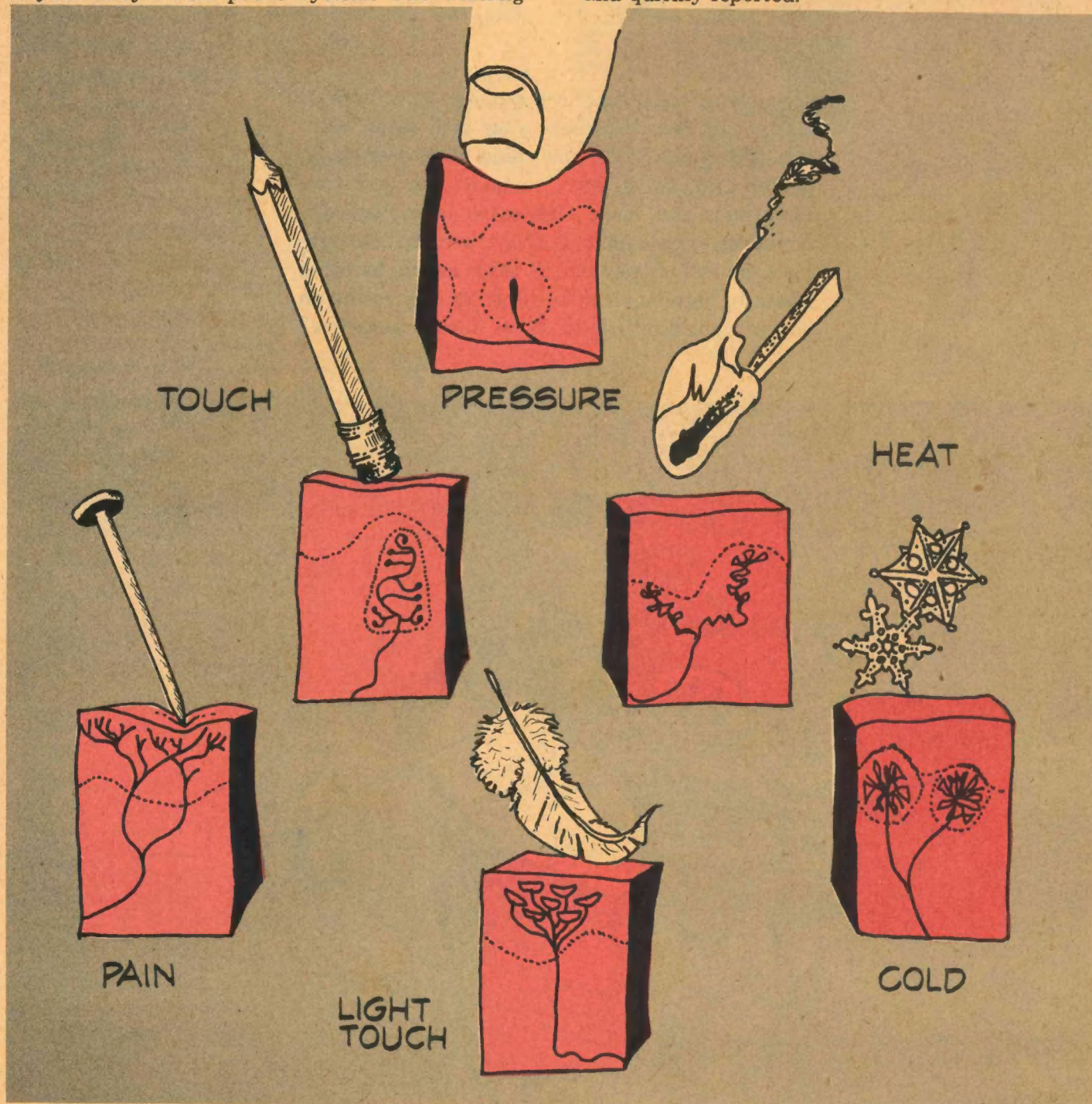


Each part of your body can feel things. Hot. Soft. Hard. Wet. These are names for some of the feelings the body receives. Under your skin there are thousands of nerves. They send messages to the brain about anything that touches the skin.

Your sense of touch, more than any other sense, is your body's best police system. The warning

signals from nerves in the skin aid the body in keeping comfortable and safe from harm by sending messages to your brain.

In the drawings below, you can see how nerves in the skin receive and report to the brain. Almost nothing can touch the skin that is not felt and quickly reported.





# LET'S REVIEW SMELL, TASTE, AND TOUCH...

Use the word bank below to find the correct word and write it in the blanks of the following sentences.

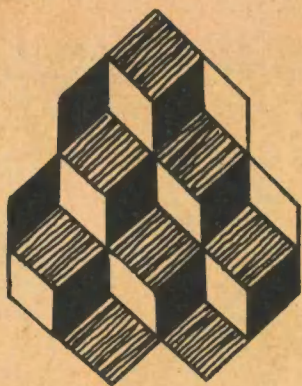
## WORD BANK

~~dull~~   ~~air~~   ~~bodyguards~~   ~~dirt~~  
~~taste~~   ~~smell~~   ~~touch~~   ~~buds~~  
~~brain~~   ~~sour~~   ~~bitter~~   ~~sweet~~

1. Your sense of smell is controlled by how well your nose works.
2. The hair in your nose helps keep dirt in the air out of your lungs.
3. Your tongue is the body part that sends reports to the brain about what you taste.
4. The bumps on your tongue are called taste buds.

5. Your sense of touch is made up of nerves that are under the skin covering your body.
6. The sense of touch sends messages to the brain about the feelings of heat, pain, cold, and pressure.
7. The four main tastes your tongue can report are salty, sour, bitter, and sweet.
8. Your senses of taste, touch, and smell are bodyguards that warn the brain of what's happening to the body.
9. Blood vessels in the nose help warm the air as it passes through on its way to the lungs.
10. A cold or too much of one kind of food or drink can make your taste buds dull.

## Just for Fun—Some Eye Tricks



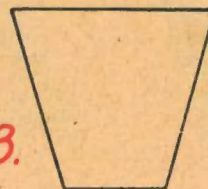
1.



2.



A.

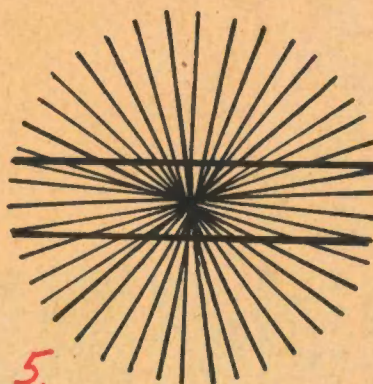


3.

B.



4.



5.

Sometimes the brain gets mixed-up about what the eye sees. Here are a few examples. Try them yourself. (1) How many boxes do you see? (2) Which ladder is longer? Or are they both the same? (3) How do the top lines in figures A and B

compare? (4) Is one line longer than the other? (5) Are the heavy lines straight or curved? Now take a ruler and check your answers by measuring the lines in numbers 2, 3, 4, and 5. Were you tricked?



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